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CHROMOSOME NUMBERS OF SOME LATIN AMERICAN SPECIES OF *ALNUS* (BETULACEAE)

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ABSTRACT

The chromosome numbers of *Alnus acuminata* H.B.K. ssp. *acuminata, A. acuminata* ssp. *arguta* (Schlechtendal) Furlow and *A. jorullensis* H.B.K. ssp. *jorullensis* were determined on material from 10 different localities of 4 Latin American countries: Columbia (6 stations), Venezuela (1), Costa Rica (2) and Guatemala (1). All the species were tetraploid (2n = 28), *A. acuminata* ssp. *arguta* and *A. jorullensis* ssp. *jorullensis* being cytologically studied for the first time.

Key Words: chromosome numbers, tropical highland forest, *Alnus acuminata, Alnus jorullensis,* Columbia, Venezuela, Costa Rica, Guatemala

INTRODUCTION

The present paper is a part of a comprehensive study, initiated in 1990 by the first author, on the genetic variation and ecology of *Alnus acuminata* H.B.K. ssp. *acuminata.* in Columbia.

This species has a large geographical and ecological distribution along the Andes cordillera, from western Venezuela to northern Argentina (Furlow, 1979). In Columbia, *A. acuminata* behaves as a pioneer species whose normal distribution is between 1700 and 3300 m in the Central and the Oriental cordilleras (Del Valle Arango and González Pérez, 1988). According to the classification system of Holdridge (1967), *A. acuminata* is present in the following types of habitats: dry forest-lower montane (df-LM), moist forest-lower montane (mf-LM), wet forest-lower montane (wf-LM), moist forest-montane (mf-M) and wet forest-montane (wf-M).

In the Central cordillera the species presents itself as a tree which can grow up to 40 m high and 70 cm in diameter. In the Oriental cordillera, however, mostly shrubby specimens are observed and only a few trees in certain habitats exceed 10 m.

Because of these phenotypic (or possibly genetic) variations, chromosome counts on some representative individuals of the species in its natural and more septentrional area were carried out. The only previous cytological determinations on Latin American material of this taxon were those of Giusti (1989) from Tucumán, in Argentina, and those of Coba de Gutiérrez and Alvarado de Coral (1989) from Manizales in Columbia. The chromosome number 2n = 28 was reported in both cases. As a

complement to the present chromosomes studies on the typical subspecies (ssp. *acuminata*), additional counts were realized on ssp. *arguta*, from Costa Rica, and on *A. jorullensis* from Guatemala.

The chromosome number 2n = 28 was the only one found in the native species of *Alnus* in Canada and in the United States (Furlow, 1979), though at least five ploidy levels are reported in the genus. Besides the tetraploid level (2n = 28) which is the most common, a diploid species (*A. inocumae* Mur & Kus. = *A. hirsuta* Turkz. var. *microphylla* Kusaka) is indicated for Japan (Chiva, 1962) and many European and Asiatic species have 2n = 42 or 2n = 56 chromosomes (Gram et al., 1941; Chiva, 1966; Furlow, 1979; Hall and Maynard, 1979; Bousquet and Lalonde, 1990). Finally, *A. firma* Sieb. & Zucc. and *A. sieboldiana* Matsum. from Japan are reported to possess 2n = 112 chromosomes (Kodama, 1967, 1970), at least in the root nodule tissues.

A few species are reputed to present two or three polyploidy levels: *A. cordata* and *A. orientalis* Decne. have both 2n = 28 or 42, *A. hirsuta* Turcz. 2n = 28 or 2n = 56, *A. glutinosa* (L.) Gaertn., *A. japonica* Sieb. et Zucc. and *A. subcordata* Mey. 2n = 28, 42, or 56 chromosomes (Gram et al., 1941; Chiva, 1966; Furlow, 1979; Hall and Maynard, 1979; Bousquet and Lalonde, 1990). The chromosome number 2n = 42 could be interpreted as the result of hybridization (Gram et al., 1941; Furlow, 1979).

MATERIAL AND METHODS

Nutlets of *A. acuminata* ssp. *acuminata* from 7 stations (6 from Columbia, one from Venezuela) were collected between June and August, 1990, by the first author. Additional seeds (*A. acuminata* ssp. *arguta* from two stations in Costa Rica and *A. jorullensis* from one provenance in Guatemala) were also received by exchange services.

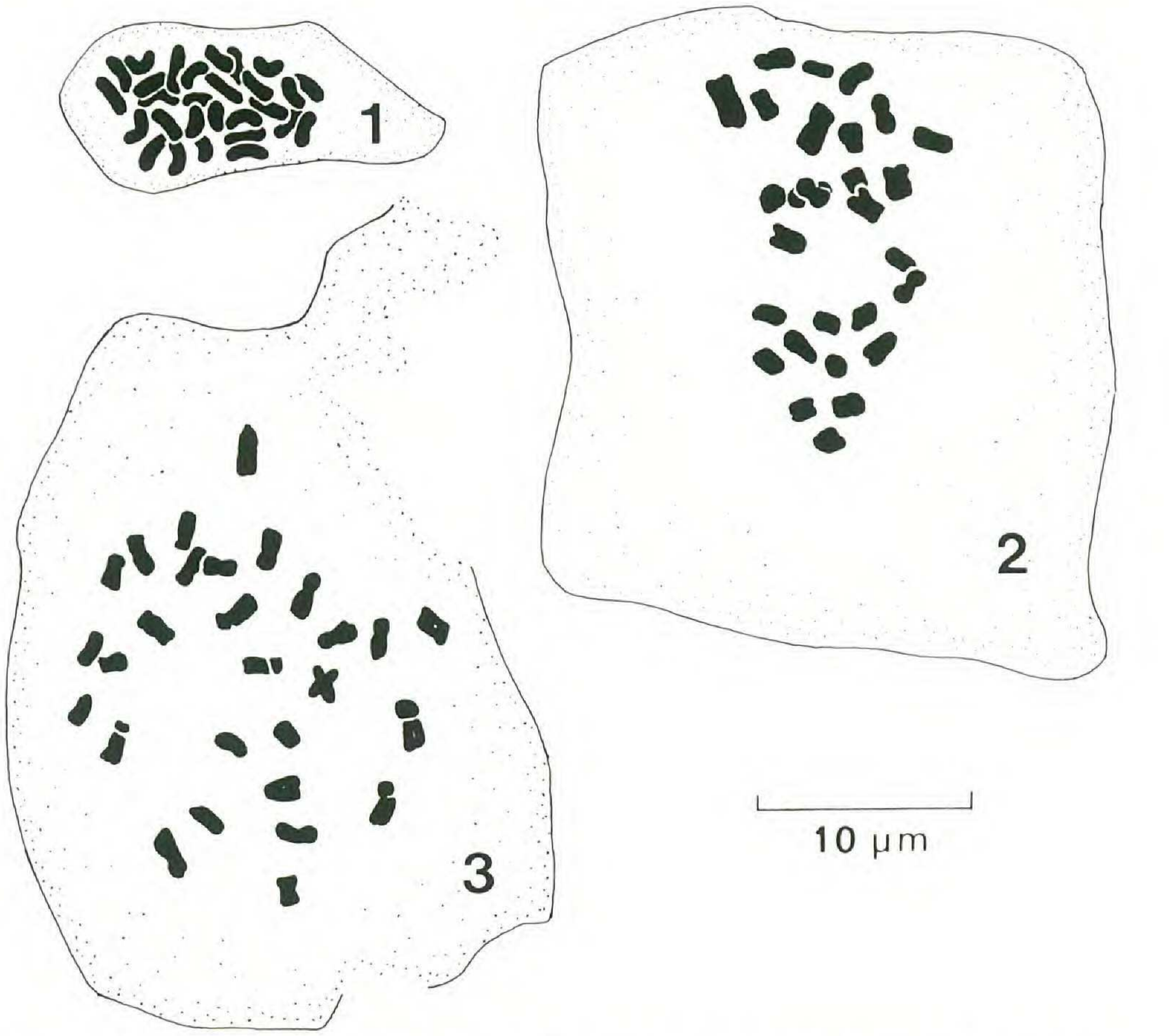
The seeds were sterilized in 6% sodium hypochlorite for 10 minutes, washed in 70% ethanol for 30 seconds and rinsed in sterile distilled water for another 30 seconds. Afterwards they were sown on a 5 mm layer of silica in Petri dishes. The Petri dishes were kept in a germination incubator with a 12 hour photoperiod and 80% humidity. The day temperature was 23°C and the night 18°C.

For the cytological study, seedlings were collected when the first

Table 1. Chromosome counts in *Alnus acuminata* H.B.K. and *A. jorullensis* H.B.K. from Latin America.

Cordillera	Locality	Latitude (N)	Longitude (W)	Altitude (m)	No. of Tree	Chr. Number* (2n)
		A. acuminata H.B.K. ssp. *acuminata*				
		Columbia				
Nudo de Pasto	Santa Lucía, La Cocha (Nariño)	1°03′	77°05′	2710	C18-1	28
Central	Rio Piendamó, Silvia (Cauca)	2°36′	76°21′	2300	C32-5	28
Central	Rio Verde, Pijao (Quindío)	4°20′	75°36′	2290	C07-3	28
Central	Cocora, Salento (Quindío)	4°45′	75°33′	2600	C11-2	28
Central	La Cristalina, Neira (Caldas)	5°21′	75°32′	2380	C02-3	28
Oriental	Rio Pómeca, Arcabuco (Boyacá)	5°44′	73°26′	2790	C30-5	28
		Venezuela				
Oriental	Rio Chama, Tabay (Mérida)	8°38′	71°04′	2050	C27-2	28
		A. acuminata ssp. *arguta* (Schlechtendal) Furlow				
		Costa Rica				
Talamanca	Jardín, Sta. María Dota (Cartago)	9°42′	83°57′	2000	CR-1	28
Volcánica Central	Prusia, Llano Grande (Cartago)	9°56′	83°54′	2200	L125-1	28
		A. jorullensis H.B.K. ssp. *jorullensis*				
		Guatemala				
Tierras Altas	Siguampar (Sacatéquez)	14°35′	90°48′	2000	AJ91-1	28

* The chromosome numbers have been counted from seeds collected *in situ*.



Figures 1–3. Somatic chromosomes in *Alnus*. **1.** *A. acuminata* ssp. *acuminata*; metaphase (2n = 28) in young leaf tissue after cold treatment (7 hr. at 4°C); Arcabuco, Columbia. **2.** *A. acuminata* ssp. *arguta*; metaphase (2n = 28) in root tip tissue after cold treatment of plantlet (7 hr. at 4°C); Santa María de Dota, Costa Rica. **3.** *A. jorullensis* ssp. *jorullensis*; metaphase (2n = 28) in root tip tissue after cold treatment of plantlet (7 hr. at 4°C); Siguampar, Guatemala.

pair of leaves appeared and were deposited in cold water in a refrigerator (4°C) for about 7 hours. This pre-treatment was necessary to shorten the chromosomes before the fixation of the seedlings in a 3:1 mixture of anhydrous alcohol and glacial acetic acid. The root tips or very young leaves were used to count the chromosomes after coloration in acetocarmine for at least 2 hours. The drawings were done with the help of a *camera lucida*.

RESULTS AND DISCUSSION

The chromosome number 2n = 28 was observed for all of the individuals studied in the three taxa (Table 1). This tetraploid

number is actually reported for all of the chromosome counts published for American species of *Alnus* (Furlow, 1979).

In our material, the chromosome being rather small (1.25 to 2.5 μm; Figures 1–3), it was not possible to prepare a karyogramme for any of the species. However, since the chromosomes of *A. jorullensis* ssp. *jorullensis,* showed more details (Figure 3), it could be tentatively assumed that 2 pairs are metacentric, 8 submetacentric, 3 acrocentric and one telocentric.

The chromosome counts for *A. acuminata* ssp. *arguta* and *A. jorullensis* ssp. *jorullensis* are apparently the first reports for these two species. The other taxon, *A. acuminata* ssp. *acuminata,* have been studied in 7 different stations from three cordilleras, one of the stations being in Venezuela and the others in Columbia (Table 1). The station of Neira, in the central cordillera, is not far from Manizales (5°15′N, 75°30′W) where the chromosome number of *A. acuminata* was earlier reported by Coba de Gutiérrez and Alvarado de Coral (1989). It could be noted that the chromosome number of this species was also found to be 2n = 28 by Giusti, the same year (1989), in Argentina.

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